

POKROVSKIY, V.I., kand.med.nauk; BARKOVA, Ye.V.; KUZNETSOV, V.S.

Clinical aspects and therapy of suppurative meningitis induced by
Afanasev-Pfeiffer's bacillus. *Pediatrics* 37 no.10:69-74 0 '59.

(MIRA 13:2)

1. Iz kafedry infektsionnykh bolezney (zaveduyushchiy - prof. K.V.
Bunin) i Moskovskogo meditsinskogo instituta imeni I.M. Sechenova
(direktor - prof. V.V. Kovanov) i 1-y Moskovskoy klinicheskoy infektsi-
onnoy bol'nitsy (glavnyy vrach - zasluzhennyy vrach RSFSR N.G.
Zaleskver).

(MENINGITIS in inf. & child.)

(HAEMOPHILUS INFLUENZAE infect.)

POKROVSKIY, V.I., kand.med.nauk; KRASIL'SHCHIK, R.B., kand.med.nauk;
~~SEREDYAKOVA~~, N.I.

Clinical aspects and treatment of pneumococcal meningitis. -
Sov.med. 24 no.3:66-72 Mr '60. (MIRA 14:3)

1. Iz kliniki infektsionnykh bolezney (zav. - prof. K.V.Bunin)
I Moskovskogo ordena Lenina meditsinskogo instituta imeni I.M.
Sechenova i l-y Moskovskoy klinicheskoy infektsionnoy bol'nitsy
(glavnyy vrach N.G.Zaleskver),
(MENINGITIS)

POKROVSKIY, V.I. (Moskva)

Rabies. Fel'd. i akush. 25 no. 7:3-6 Je '60.
(RABIES)

(MIRA 13:8)

POKROVSKIY, V.I., kand.med.nauk; BULKINA, I.G., dotsent

Course of typhoparatoid diseases and their antibiotic therapy
at the present time. Terap.arkh. 32 no.11:49-57 N '60.

(MIRA 14:1)

1. Iz kliniki infektsionnykh bolezney (zav. - prof. K.V. Banin)
1 Moskovskogo ordena Lenina meditsinskogo instituta imeni I.M.
Sechenova.

(PARATYPHOID FEVER) (TYPHOID FEVER) (ANTIBIOTICS)

BULKINA, I.G.; BUNIN, K.V., prof.; KUZNETSOV, V.S.; MIKHAYLOVA, Yu.M.;
NOVAKOVSKAYA, A.A.; ~~POKROVSKIY, V.I.~~; POLUMORDVINOVA, Ye.D.; SEDLOVETS,
M.P.; STARSHINOVA, V.S.; ~~TSEIDLER, S.A.~~; SHKHAVTSABAYA, T.V.; YAKHON-
TOVA, N.K.; SHERESHEVSKAYA, Ye.F., red.; ZUYEVA, N.K., tekhn. red.

[Pocket manual for the specialist in infectious diseases; clinical
aspects, diagnosis, and treatment] Karmannyi spravochnik infektsioni-
sta; klinika, diagnostika, lechenie. Moskva, Gos. izd-vo med. lit-ry
Medgiz, 1961. 233 p. (MIRA 14:7)
(COMMUNICABLE DISEASES) (MEDICINE--HANDBOOKS, MANUALS, ETC.)

POKROVSKIY, V.I.; MIKHAYLOVA, Yu.M.

Effect of antibiotic allergy on Widal reaction titers. Antibiotiki
6 no.2:138-141 F '61. (MIRA 14:4)

1. Klinika infektsionnykh bolezney (zav. - prof. K.V.Bunin)~I
Moskovskogo ordena Lenina meditsinskogo instituta imeni I.M.
Sechenova.

(TYPHOID FEVER)

(ANTIBIOTICS)

POKROVSKIY, V.I.

Some manifestations of the side effects of antibiotics used on
patients with suppurative meningitis. Antibiotiki 6 no.10:947-952
0 '61. (MIRA 14:12)

1. Klinika infektsionnykh bolezney (zav. - prof. K.V.Bunin) I
Moskovskogo ordena Lenina meditsinskogo instituta imeni I.M.Sechenova.
(MENINGITIS) (ANTIBIOTICS...PHYSIOLOGICAL EFFECTS)

POKROVSKIY, V.I.

"Prescription manual." Edited by P.V.Rodionov. Reviewed by V.I.
Pokrovskii. Sov. med. 25 no.3:152-154 Mr '61. (MIRA 14:3)
(MEDICINE, FORMULAE, RECEIPTS, PRESCRIPTIONS)
(RODIONOV, P.V.)

POKROVSKIY, V.I. (Moskva)

Acute adrenal insufficiency in meningococcemia. Klin.med. 39
no.3:54-59 Mr '61. (MIRA 14:3)

1. Iz kliniki infektsionnykh bolezney (zav. - prof. K.V. Bunin)
I Moskovskogo ordena Lenina meditsinskogo instituta imeni
I.M. Sechenova.
(MENINGOCOCCUS) (ADRENAL GLANDS—DISEASES)

L 12811-66 EWT(1)/EWA(j)/T/EWA(b)-2 JK
ACC NR: AP5028185

SOURCE CODE: UR/0248/65/000/008/0060/0064
36
B

AUTHOR: Koptelova, Ye. I.; Pokrovskiy, V. I.; Gorshkova, Ye. P.

ORG: Institute of Epidemiology and Microbiology im. N. F. Gamaley, AMN SSSR, Moscow
(Institut epidemiologii i mikrobiologii AMN SSSR); Moscow Medical Stomatological In-
stitute (Moskovskiy meditsinskiy stomatologicheskiy institut)

TITLE: A model of experimental meningitis in rabbits induced by L-forms of strepto-
cocci and staphylococci

SOURCE: AMN SSSR. Vestnik, no. 8, 1965, 60-64

TOPIC TAGS: bacteria, mycoplasm, infective disease, microbiology

ABSTRACT: Since L-forms are present in patients with meningitis, meningoencephali-
tis, and brain abscesses but not during the recovery period, the authors conjectured
that not only the bacterial but the L-forms play a pathogenetic role in these dis-
eases. To test their assumption, they injected rabbits suboccipitally with two
strains of stable L-cultures of hemolytic streptococci (L-196 and L-409), one strain
of a staphylococcal L-culture (L Lossmanov), bacterial forms of β -hemolytic

UDC: 616.832.9-002-022.7-092.9

Card 1/2

L 12811-66

ACC NR: AP5028185

streptococcus (No. 10-S), and staphylococcus (Lossmanov). The meningitis induced by injecting the bacterial cultures into the subarachnoid space had an acute course and lethal outcome in most of the animals within 5 days. On the other hand, the meningitis that followed injection of the L-forms, though marked by the same clinical symptoms, was characterized by a longer and more sluggish course and the animals survived 7-15 days. Histological analysis of the brain and meninges showed that infection with L or bacterial cultures gives rise to a similar diffuse inflammatory reaction. Thus, meningitis and meningoencephalitis can be experimentally induced both by bacterial forms and by stable L-cultures. With the latter, the clinical course of the disease seems to be related to the species specificity of the L-forms. Orig. art. has: 2 figures, 1 table.

SUB CODE: 06/ SUBM DATE: 29May65/ ORIG REF: 001/ OTH REF: 002

jw

Card 2/2

POKROVSKIY, V.I.; GUSEVA, T.M.

Changes in the blood serum electrolyte levels in purulent meningitis following the use of massive penicillin doses. Antibiotiki 9 no.2:156-158 F '64. (MIRA 17:12)

1. Kafedra infektsionnykh bolezney (zav.- prof. K.V. Bunin). I Moskovskogo meditsinskogo instituta i gruppy deystvitel'nogo chlena AMN SSSR prof. Ye.M. Tareyeva na baze Moskovskoy infektsionnoy gorodskoy klinicheskoy bol'nitsy No.7.

KOPTELOVA, Ye.I.; POKROVSKIY, V.I.; GORSHKOVA, Ye.P.

Model of experimental meningitis in rabbits caused by streptococcal and staphylococcal L-forms. Vest. AMN SSSR 20 no.8:60-64 '65.
(MIRA 18:9)

1. Institut epidemiologii i mikrobiologii imeni N.F.Gamalei
AMN SSSR, Moskva, i Norkovskiy meditsinskiy atomatologicheskii
institut.

KAGAN, G.Ye.; KATSEVA, Ye.I.; ROMOVSKIY, V.I.

Isolation of PPLO, ϕ -forms and heteromorphous forms of bacterial growth from the cerebrospinal fluid of patients with purulent meningitis. Zhur. mikrobiol., epid. i immun. 42 no.2:105-110 7

(MIRA 1816)

1. Institut epidemiologii i mikrobiologii imeni Gamalei AMN SSSR
i i Moskovskiy ordena Lenina meditsinskiy institut.

KOPTELAVA, Ye.I.; POKROVSKIY, V.I.

Experimental meningitis in rabbits caused by L-form streptococci.
Zhur. mikrobiol., epid. i immun. 41 no.10:90-93 '64.

(MIRA 18:5)

1. Institut epidemiologii i mikrobiologii imeni Gamalei AMN SSSR
i i Moskovskiy ordena Lenina meditsinskiy institut.

L 42430-65 EWT(1)/EWA(j)/EWA(b)-2 JK
ACCESSION NR: AP5007995

S/0016/65/000/002/0105/0110

AUTHOR: Kagan, G. Ya.; Koptelova, Ye. I.; Pokrovskiy, V. I.

TITLE: Isolation of PPLO-, L-forms and heteromorphic growth forms of bacteria from the cerebrospinal fluid of patients with purulent meningitis

SOURCE: Zhurnal mikrobiologii, epidemiologii i immunobiologii, no. 2, 1965, 105-110

TOPIC TAGS: microbiology, meningitis, bacteriologic culture method, cerebrospinal fluid, bacteria

ABSTRACT: Microbiology of purulent meningitis was investigated by culturing the cerebrospinal fluid of patients and of a control group on 3 different media: 1) medium containing transforming and stabilizing agents to produce optimal conditions for L-form isolation, 2) medium containing only stabilizing agents to produce optimal conditions for isolation of heteromorphic growth forms, and 3) medium without transforming or stabilizing agents to produce optimal conditions for isolation of bacterial forms and their

Card 1/2

L 42430-65

ACCESSION NR: AP5007995

2

reversions from L-forms and heteromorphic growth forms. The bacterial forms were identified by a general bacteriological analysis method. Investigation of 144 patients affected by purulent meningitis, including 8 with abscesses of the brain, revealed bacteria of various types in 21 patients, heteromorphic growth forms and unstable L-forms in 4 patients, mixed cultures of bacterial and L-forms in 5 patients, and stable L-forms (PPL0) in 22 patients. No growth was found in the cerebrospinal fluid cultures of 25 control patients (tuberculosis and viral meningitis). Unstable and stable L-forms and also granular forms were found particularly in cases of protracted severe cases of meningitis and brain abscesses. Generally, negative cultures coincided with complete recovery. The problem of whether these bacterial forms develop in the organism under the effect of various transforming agents of a chemical and biological nature or whether they are the result of direct infection is not clear at this time. Orig. art. has: 4 figures.

ASSOCIATION: Institut epidemiologii i mikrobiologii im. N. F.

Gamalei AMN SSSR (Institute of Epidemiology and Microbiology AMN SSSR); I Moskovskiy ordena Lenina meditsinskiy institut (The First Moscow Lenin Order Medical Institute)

Card 2/3

SUBMITTED: 5 Sep 63

SOBOLEV, V.R.; POKROVSKIY, V.I.

Distribution of antibiotics of the tetracycline group in the
body in some diseases. Sovet. med. 27 no.6:129-134 Je'63
(MIRA 17:2)

1. Iz kafedry mikrobiologii (zav. - chlen-korrespondent AMN
SSSR prof. Z.V. Yermol'yeva) Tsentral'nogo instituta usover-
shenstvovaniya vrachey i kafedry infektsionnykh bolezney
(zav. - prof. K.V. Bunin) I Moskovskogo ordena Lenina medi-
tsinskogo instituta.

KOLOMOYTSEVA, I.P.; POKROVSKIY, V.I.

Use of large antibiotic doses in treating acute purulent diseases of the nervous system. Trudy 1-go MMI 24:297-303 '63
(MIRA 17:3)

TSEYDLER, S.A., kand.med.nauk; POKROVSKIY, V.I., kand.med.nauk;
ZHITENEVA, L.P. (Moskva)

Benign lymphoreticulosis (cat scratch disease). Klin.med. 38
no.3:95-101 Mr'60. (MIRA 16:7)

1. Iz kafedry infektsionnykh bolezney (zav.-prof. K.V.Bunin)
I Moskovskogo ordena Lenina meditsinskogo instituta imeni
Sechenova.

(CAT SCRATCH DISEASE)

POKROVSKIY, V.I.; LIBIYAYNEN, L.T.

Clinical aspects of serous meningitis in epidemic parotitis.
Kaz.med.zhur. no.5:45-47 S-O '62. (MIRA 16:4)

1. Kafedra infektsionnykh bolezney (zav. - prof. K.V.Bunin)
1-go Moskovskogo ordena Lenina meditskogo instituta imeni
Sechenova.

(MENINGITIS)

(MUMPS)

ZEFIROVA, G.S.; POKROVSKIY, V.I. (Moskva)

Characteristics of the course of Addison's disease in children.
Vop. okh. mat. i det. 7 no.2:37-41 F '62. (MIRA 15:3)

1. Iz kafedry endokrinologii (zav. - prof. N.A. Shereshevskiy)
TSentral'nogo instituta usovershenstvovaniya vrachey (dir.
M.D. Kovrigina) i kafedry infektsionnykh bolezney (zav. - prof.
N.I. Bunin) I Moskovskogo ordena Lenina meditsinskogo instituta
imeni I.M. Sechenova.

(ADDISON'S DISEASE)

POKROVSKIY, V.I.; CHERNOKHVESTOVA, Ye.V.; NIKITINA, V.D.

Properdine system and its role in infection and immunity. Report
No. 7. Zhur.mikrobiol., epid.i immun. 33 no.8:131 Ag '62.

(MIRA 15:10)

1. Iz Moskovskogo instituta epidemiologii i mikrobiologii i iz
kafedry infektsionnykh bolezney I Moskovskogo ordena Lenina
meditsinskogo instituta.

(PROPERDINE)

(MENINGES--TUBERCULOSIS)

(MENINGITIS)

POKROVSKIY, V.I.; SOBOLEV, V.R. (Moskva)

Use of tetracyclines in suppurative meningitis. Klin.med. no.9:
46-51 '62. (MIRA 15:12)

1. Iz kafedry infektsionnykh bolezney (zav. - prof. K.V. Bunin)
I Moskovskogo ordena Lenina meditsinskogo instituta na baze Moskov-
skoy klinicheskoy infektsionnoy bol'nitsy No.7 (glavnyy vrach
N.G. Zaleskver) i kafedry mikrobiologii (zav. - chlen-korrespondent
AMN SSSR prof. Z.V. Yermol'yeva) TSentral'nogo instituta usover-
shenstvovaniya vrachey.

(TETRACUCLINE) (MENINGITIS)

POKROVSKIY, V.I.

Advances in the treatment of purulent meningitis. Sov. med.
25 no.4:97-102 Ap '62. (MIRA 15:6)

1. Iz kliniki infektsionnykh bolezney (zav. - prof. K.V.
Bunin) I Moskovskogo ordena Lenina meditsinskogo instituta
imeni I.M. Sechenova.

(MENINGITIS)

(PENICILLIN)

POKROVSKIY, V.I.

Cases of anemia in diphyllbothriasis and adrenal insufficiency
(Addison's disease). Med.paraz.i paraz.bol. 30 no.2:185-188
M-Apr '61. (MIRA 14:4)

1. Iz kafedry infektsionnykh boleaney I Moskovskogo ordena Lenina
meditsinskogo instituta imeni I.M. Sechenova (dir. instituta -
prof. V.V. Kovanov, zav. kafedroy - prof. K.V. Bunin).
(TAPEWORMS) (ANEMIA) (ADDISON'S DISEASE)

POKROVSKIY, V. I.

USSR / Radiophysics

I

Abs Jour : Ref Zhur - Fizika, No 5, 1957, No 9935

Author : Pokrovskiy, V. I.

Inst : West-Siberian Branch, Academy of Sciences USSR

Title : Optimum Linear Antennas, Radiating Perpendicular to the Axis.

Orig Pub : Dokl. AN SSSR, 1956, 109, No 4, 769-770

Abstract : The problem of determining the currents in a linear antenna with optimum ratio between the width of the principal lobe and the level of the lateral lobes of the directivity pattern was solved by Dolph (Dolph, C.L., Proceedings IRE, 1946, 34, 335) who indicated that the so-called polynomial of the antenna, connected with the currents in the various radiators of the antenna, should coincide with the Chebyshev polynomial. The author indicates, that if the distance d bet-

Card : 1/2

POKROVSKIY, V.K.

Determination of oxygen and air consumption and of the basic
parameters of fermentors and the estimation of aerators in
the process of subsurface cultivation of aerobic micro-or-
ganisms. Gidroliz. i biokhimiya. prom. 17 no.403-4 (1961)
(MIRA 1787)

1. VNIIsintezbionk.

POKROVSKIY, V. L.

✓ Onsager's theory of the dipole lattice. V. L. Pokrovskii
(Electrotech. Commun. Inst., Novosibirsk). *Zhur. Eksp. i
62 Teoret. Fiz.* 28, 501-3(1955).—Math. L. Onsager's
(C.A. 38, 1930*) theory of the dipole lattice is discussed for
the case of a 2nd-order phase transition. J. R. L.

POKROVSKIY, V. L.

621.996.677.3 1337
Optimum Linear Aerials V. L.
Pokrovskiy (Radioelektronika i Elektronika, May
1956, Vol. 1, No. 5, pp. 593-600.) The
current distribution in linear broadside
arrays is considered, using Tchebycheff-
Akhiezer polynomials; the optimum solu-
tion can be obtained not only for radiator
spacings of $d > \lambda/2$, but also for $d < \lambda/2$.

Boag

POKROVSKIY, V.L.

USSR/Theoretical Physics - Quantum Mechanics.

B-4

Abs Jour : Ref Zhur - Fizika, No 4, 1957, 8407

Author : Pokrovskiy, V.L., Rumer, Yu.B.

Inst : Western Siberia Branch, Academy of Sciences USSR.

Title : Remarks on the Pauli Theorem Concerning the Connection
Between the Spin and the Statistics.

Orig Pub : Zh. eksperim. i teor. fizihi, 1956, 31, No 1, 337-338.

Abstract : The proof given by Pauli (Pauli, W. Relativistic Theory
of Elementary Particles, ILL, 1947, Supplement) for a
theorem concerning the connection between the spin and
the statistics is based on a consideration of irreducible
representations of the tensor and spinor quantities in
transformations of a Lorentz group with a determinant
equal to unity. The authors give a proof of the above
theorem in which it is shown that it is enough to res-
trict oneself to a consideration of the transformation
of the quantities with general inversion (inversion of
all four coordinate axes).

Card 1/1

POKROVSKIY, V.L.

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1506
 AUTHOR POKROVSKIY, V.L., RUMER, JU.B.
 TITLE On PAULI'S Theorem concerning the Correlation between Spin and Statistics.
 PERIODICAL Žurn.eksp.i teor.fiz, 31, fasc. 2, 337-338 (1956)
 Issued: 10 / 1956 reviewed: 11 / 1956

The proof of this theorem offered here shows that observation of the transformations of the quantities on the occasion of the inversion of all coordinate axes (general inversion I) is adequate. Furthermore, this proof stresses the close connection between SCHWINGER'S ideas and those of PAULI. On the occasion of the transformation of the general inversion for any vector A it is true that $IA = -A$. In the case of the general inversion the tensors of even rank T_{2n}

therefore remain invariant ("class +"), whereas the tensors with odd rank T_{2n+1} change their sign ("class -").

Here the transformations of spinors on the occasion of a general inversion are studied. While the general character is maintained, only spinors of the first rank are investigated. On the occasion of reflection on to a twodimensional surface with the normal vector a_k the spinor U is transformed according to the following rule: $U' = \hat{A}U$, $\bar{U} = \bar{U}\hat{A}$, $\hat{A} = ia_k \gamma_5 \gamma_k$, $\bar{U} = U^\dagger \gamma_4$. Here $\hat{A}^2 = a_k a_k$.

The bilinear quantities which are composed of U and $\bar{U}$ behave on the occasion of spatial reflections like tensors, but in the case of time reflections they behave like pseudotensors. The definition of the rules of the reflection of

POKROVSKIY, V.L.

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1625
 AUTHOR POKROVSKIY, V.L.
 TITLE A Theorem on the Equality of the Cross Sections of the Photoproduction of Charged Pions on Nuclei with the Isotopic Spin 0.
 PERIODICAL Zhurn.eksp.i teor.fiz, 31, fasc.3, 537-538 (1956)
 Issued: 12 / 1956

The HAMILTONIAN of the interaction of nucleons and pions with the electromagnetic field with respect to the rotation group of the charge space represents the sum of a scalar S and the third component V_3 of a vector:

$$I_{int} + S + V_3; S = -(ie/2) \sum_V \vec{v}^V \vec{A}(x_V); V_3 = ie \left[\sum_V T_3^V \vec{v}^V(x_V) + \sum_\mu T_3^\mu \vec{v}^\mu \vec{A}(x_\mu) \right].$$

Here $\vec{v}^V$ - denotes the operator of velocity, T_3^V - the operator of the projection of the isotopic angular momentum of the V-th nucleon; $\vec{v}$ and T_3^μ - the analogous quantities for the μ -th meson. From this HAMILTONIAN there follows a theorem for the conservation of the projection of the isotopic spin of the system consisting of nucleons and pions on to the axis 3 (theorem of the conservation of charge), and the following selection rules for the total isotopic spin T of the system: $\Delta T = 0, +1$.

The matrix elements of the operators corresponding to the transitions with conservation of the number of nucleons are, with respect to the group of permutations P_n , invariant only to the charge variable. Therefore the matrix element of the operator is different from zero if KRONCKER'S product of the representa-

✓
Zurn.eksp.i teor.fis, 31, fasc.3, 537-538 (1956) CARD 2 / 2 PA - 1625

tions of the group P_n (according to which the wave functions of the initial and end states as well as the operators are transformed) contains the unit representation.

Next it is shown that in the case of the photoproduction of charged mesons on nuclei with the isotopic angular momentum zero the matrix element $(\Psi_f | S | \Psi_i)$ is equal to zero.

From the forbidding rule $\Delta T = 0, \pm 1$ and from the usual addition rule of the angular momentum it follows that the isotopic angular momentum of the nucleus in the final state may be equal to 1 or 2. By employing the known expression for the matrix elements of the vector it is possible to show that the cross sections of the photoproduction of the differently charged mesons are the same for the two possible values of the isotopic spin of the nucleus in the final

state: $d\sigma_1(\pi^+) = d\sigma_1(\pi^-)$, $d\sigma_2(\pi^+) = d\sigma_2(\pi^-)$. By summation over the possible final states $d\sigma(\pi^+) = d\sigma(\pi^-)$ is obtained. The experimental values of $r = d\sigma(\pi^-) / d\sigma(\pi^+)$ are equal to 1 for the light nuclei ($D, C^{12}, N^{14}, O^{16}$) within the limits of measuring errors. The reduction of r in the case of an increasing charge may apparently be explained by the absorption of the negative pions by the nuclei.

INSTITUTION: Westsiberian Branch of the Academy of Science in the USSR

POKROVSKIY, V.L.

SUBJECT USSR / PHYSICS
 AUTHOR POKROVSKIY, V.L.
 TITLE On Optimum Linear Antennae the Radiation of which is Vertical to the Axis.
 PERIODICAL Dokl. Akad. Nauk, 109, fasc. 4, 769-770 (1956)
 Issued: 10 / 1956 reviewed: 10 / 1956

CARD 1 / 2

PA - 1439

Here the problem of the optimum distribution of currents for any distance d between the emitters is solved. In order to be as brief as possible only the class of symmetrical antennae is dealt with here in which the amperages in emitters located at an equal distance from the center are equal. The optimum distribution obtained on this occasion is the linear in the case of all linear antennae. In the case under investigation the polynomial $P_n(z)$ of the antennae then assumes the following form (where $z = e^{i(2\pi d/\lambda) \sin \theta}$: for even $n = 2\gamma$ ($n+1$ is the number of the emitters):

$$P_{2\gamma}(f) = \sum_{k=0}^{\gamma} a_k f^{2k}; \quad a_k = \sum_{p=k}^{\gamma} \sum_{m=p-k}^p (-1)^{k-p} C_{2p}^{2m} C_m^{p-k} I_p \text{ and for odd } n=2\gamma-1: P_{2\gamma-1}(f) = \sum_{k=1}^{\gamma} a_k f^{2k-1}; \quad a_k = \sum_{p=k}^{\gamma} \sum_{m=p-k}^{p-1} (-1)^{p-k} C_{2p-1}^{2m} C_m^{p-k} I_p.$$

Here $f = (\sqrt{z} + 1/\sqrt{z})/2$ and $I_k = I_{-k}$ denote the amperage in the k -th emitter (in which case numbering begins from the center of the antenna). The polynomials $P_n(f)$ corresponding to the optimum antennae have the following properties:
 1.) In the case of an assumed $P_n(1)$ the value f_1 , which is next to 1 and for

POKROVSKIY, V. L. Doc Cand Phys-Math Sci -- (di s) "Theory
of ~~the~~ optimum line antennae." Novosibirsk, 1957. 6 pp 20 cm.
(Academy of Sciences USSR. West-Siberian Affiliate. Tomsk
State Univ im V.V. Kuybyshev), 100 copies
(KL, 21-57, 98)

-14-

POKROVSKIY, V.L.

AUTHOR:

TITLE:

PERIODICAL:

ABSTRACT:

POKROVSKIY, V.L.

109-5-5/22

The Optimum Line Aerials Emitting at an Angle Set to the Axis. (Optimal'nyye lineynyye antennoy izluchayushchiye pod zadannym uglom k osi, Russian) Radiotekhnika i Elektronika, 1957, Vol 2, Nr 5, pp 559 - 565 (U.S.S.R.)

The optimum CHEBYSHEV distributions are here generalized for the case of an aerial with any distance between the emitters and any direction of maximum emission. All terms are taken from the author's paper in Doklady Akademii Nauk SSSR, Vol 109, 41, 652. Only the case $d < \frac{\lambda}{2}$ is investigated here. The example itself is not solved, since the solution is a merely mathematical matter which is published separately. Only the final results are given here. It is shown that, in the case of different values of c , R and a , the minimum width of ray can be realized by functions of three types. The dependence of the optimum directivity diagram on the direction of the main flash is investigated and it is shown that for aerials emitting along the axis a substantial reduction of ray-width can be obtained as compared to aerials emitting at a small angle set to the axis. Aerials emitting at an angle approaching the

Card 1/2

POKROVSKIY, V.L.

109-4-3/20

AUTHOR: Pokrovskiy, V.L.

TITLE: On the Design of the Optimum Antennae radiating along their Axis. (O raschete optimal'nykh antenn, izluchayushchikh vdol osi)

PERIODICAL: Radiotekhnika i Elektronika, 1957, Vol.2, No.4, pp. 389 - 394 (USSR).

ABSTRACT: The problem is formulated as follows. The antenna consists of $(n + 1)$ radiators, in which the amplitudes of currents are I_k (where $k = -\frac{n}{2}, -\frac{n}{2} + 1, \dots, \frac{n}{2}$). It is necessary to find the distribution of current I_k , such that for a fixed ratio of the peak value of the main lobe to the maximum value of the side lobes, the width of the main lobe will be a minimum. Mathematically, the problem amounts to finding a "quasipolynomial" $R_n(z)$, which is expressed as:

$$R_n(z) = \sum_{k=-\frac{n}{2}}^{\frac{n}{2}} I_k z^k, \text{ where } z = e^{i \frac{2\pi}{\lambda} \sin \theta} = e^{i\varphi} \quad (1)$$

The quantities entering into the expression for $R_n(z)$ were Card 1/3 defined by the author in an earlier work [Ref.3]. It is shown

109-4-3/20

On the Design of the Optimum Antennae radiating along their Axis.

that for $d = \lambda/2$, where d is the spacing between the radiators and λ is the radiated wavelength, the currents in the individual radiators should be the same as in the Dolf antenna (which radiates perpendicularly to the axis), but the phases of the neighbouring radiators should differ by 180° . The case of the antenna for which $d < \lambda/2$ is considered in detail; the formula for the width θ of the main lobe is in the form:

$$\theta = \frac{a - x_1}{a} = \frac{2\text{ch}^2(\frac{1}{2n} \text{Arch}R) \text{sh}^2(\frac{1}{2n} \text{Arch}R)}{\text{ch}^4(\frac{1}{2n} \text{Arch}R) - \sin^2 \alpha/2} \quad (12)$$

so that the minimum possible width is:

$$\theta_{\min} = 2\text{th}^2(\frac{1}{2n} \text{Arch}R)$$

where $\alpha = 2\pi d/\lambda$ and R is the ratio of the main lobe to the maximum side-lobe. The above results for θ are compared with those obtained by D.R. Rhodes [Ref.2] and it is shown that in some cases the two methods give almost identical solutions. The paper contains one figure and three references, of which 1

Card 2/3 is Slavic.

On the Design of the Optimum Antennae radiating along their Axis. 109-4-3/20
SUBMITTED: June 20, 1956.
AVAILABLE: Library of Congress.
Card 3/3

POKROVSKIY, V. L.

109-12-14/15

AUTHOR: Pokrovskiy, V.L.

TITLE: On the Theory of Optimum Linear Antennae (K teorii optimal'nykh lineynykh antenn) (Letter to the Editor)

PERIODICAL: Radiotekhnika i Elektronika, 1957, Vol.II, No.12, pp. 1550 - 1551 (USSR)

ABSTRACT: In an earlier work (Ref.1), the author solved the problem of the distribution of currents in a linear antenna, consisting of a number of equidistantly placed dipoles, which gave an optimum directional pattern. Recently, the author has been able to investigate the problem in more detail and, in particular, to explain the dependence of the radiation pattern on the parameter:

$$\psi = \frac{2\pi d}{\lambda}$$

(the notation used is the same as in the earlier work). The results are briefly reported. There is 1 Slavic reference.

SUBMITTED: July 30, 1957

AVAILABLE: Library of Congress
Card 1/1

POKROVSKIY, V. L.

12937

19
A THEOREM ON THE EQUALITY OF THE CROSS SEC-
TIONS FOR PHOTOPRODUCTION OF CHARGED P-

MESSONS ON NUCLEI WITH ISOTOPIC SPIN ZERO. V. L.

Pokrovskii (West Siberian Branch of the Academy of
Sciences, USSR). Soviet Phys. JETP 4, 459-60 (1957) Apr.

Prof
only

POKROVSKIY, V.L.

AUTHOR

POKROVSKIY, V.L.

56-7-43/66

TITLE

The Generalized Gauge Invariance and Combined Inversion
(Obobshchennaya kalibrovochnaya invariantnost' i kombinirovannaya in-
versiya. Russian)

PERIODICAL

Zhurnal Eksperim. i Teoret. Fiziki, 1957, Vol 33, Nr 7, pp 269 - 271

ABSTRACT

According to the opinion at present predominating certain particles
(pions, K-particles, hyperons, etc.) can occur in various charge states.
Their wave functions are written down in the form $\Psi = \sum_Q c_Q \Psi_Q$, where
 Ψ_Q denotes the wave function of the state with the charge Q. Summa-
tion extends over the possible values of the charge (including zero).
The description of such particles necessitates a certain extension of
the conception of gauge invariance. For particles that exist in only
one charge state the gauge transformation is reduced to the multipli-
cation of the wave function with an insignificant phase factor $e^{i\alpha Q}$.

In the general case the formula $\Psi' = \sum_Q c_Q e^{i\alpha Q} \Psi_Q$ apparently applies

to the gauging transformation. The function Ψ' depends parametrically
on α . The postulate of invariance with respect to the just mentioned
infinitely small gauging transformation leads to the law of the conserv-
ation of charge, which is here given in form of a continuity equation
for dielectric charge. The author here makes use of the orthogonality

Card 1/2

The Generalized Gauge Invariance and Combined Inversion

56-7-43/66

of the various charge states ψ_Q and of the usual representation of the Lagrangian which furnishes equations of first order for the wave function ψ . In the theory of bosons with several charge states the transformation $\psi'_Q = \psi_Q$; $c'_Q = c_Q$ must be carried out when the sign of the current and of the charge is changed. The wave functions of the particles existing in only one charge state can, as we know, be subjected to a gauge transformation in which α is any function of the coordinates. The generalization of such a transformation for the case under investigation is the replacement of the parameter α by $\alpha' = f(x, \alpha)$. The following general theorem applies: A theory that is not invariant with respect to change of the orientation of spatial directions, is not invariant with respect to the change of the sign of the charge. However, such a theory is invariant with respect to the combined inversion by Landau, i.e. with respect to the simultaneous transformation $\vec{x}' = -\vec{x}$ and $\alpha' = -\alpha$. (No illustrations)

West Siberian Branch of the Academy of Sciences of the U.S.S.R.
(Zapadno-Sibirskiy filial Akademii nauk SSSR)

ASSOCIATION

PRESENTED BY

SUBMITTED

AVAILABLE

15.2.1957

Library of Congress

Card 2/2

POKROVSKIY, V. L.

AUTHOR

POKROVSKIY, V. L., RUMER, Yu. B.

56-7-47/66

TITLE

On the Problem of Conservation of Parity in the Theory of Elementary Particles.

(K voprosu o sokhraneni chetnosti v teorii elementarnykh chastits.- Russian)

PERIODICAL

Zhurnal Eksperim. i Teoret. Fiziki 1957, Vol 33, Nr 7, pp 277-279 (USSR)

ABSTRACT

The fivedimensional optics suggested by Yu. B. RUMER (Issledovaniya po 5-optike, GTTI, 1956, Usp. mat. nauk, Vol 8, 6, 1953) furnishes a natural classification of the phenomena in which parity is either conserved or not. The fivedimensional optics is based upon the newly discovered extensive symmetry of the equations of classical mechanics and the quantum mechanics in space, time, and effect. In fivedimensional optics the coordinates, time, and the effects are comprised within a fivedimensional metric space which is closed topologically in the coordinate of effect with the period h (Plank's constant). In a corresponding manner momentum, energy, and charge are combined to a fivedimensional vector, for which a uniform law of conservation is formulated. Also in the fivedimensional theory the Lagrangian of interaction must be built up from the wave

CARD 1/2

On the Problem of Conservation of Parity in the Theory
of Elementary Particles.

56-7-47/66

functions of the interacting particles. The authors here
enumerate all possible products of spin components, they
can be subdivided into irreducible groups. Also in the five-
dimensional space a spinor is a quantity with 4 components.
In conclusion the emission of a boson by a fermion and the
decay of a boson into two fermions is studied in short.
(No Illustrations)

ASSOCIATION: West-Siberian Branch of the Academy of Sciences of the USSR.
(Zapadno-Sibirskiy filial Akademii nauk SSSR.- Russian)

PRESENTED BY: -

SUBMITTED: 14.3. 1957

AVAILABLE: Library of Congress.

CARD 2/2

SOV/56-34-5-32/61
 AUTHORS: Pokrovskiy, V. L., Savvinykh, S. K., Ulinich, F. R.
 TITLE: Superbarrier Reflection in Quasi-Classical Approximation
 (Nadbar'yernoje otryazheniye v kvaziklassicheskom priblizhenii)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1958,
 Vol. 34, Nr 5, pp. 1272 - 1277 (USSR)

ABSTRACT: The purpose of this paper is the determination of an asymptotical expression for the coefficients of reflection in the case of short wave lengths. The authors restrict themselves to the one-dimensional case. The problem is represented by the solution of the Schroedinger (Shredinger) equation:

$$\alpha^2 \frac{d^2 \psi}{d\xi^2} + k^2(\xi) \psi = 0$$

where $\alpha = \lambda/a$; $\xi = x/a$; $k^2(\xi) = 1 - U(\xi)/E$ holds. λ denotes the De Broglie (De Broyl') wave length of the free particle. The main assumption is $\alpha \ll 1$. The authors everywhere restrict themselves to the case $E > U(\xi)$ on the whole ξ -axis.

Card 1/3

Superbarrier Reflection in Quasi-Classical Approximation SOV/56-34-5-32/61

The solution of this Schroedinger equation is determined by the usual WKP (Wentzel-Kramers-Brillouin) method in the form $\psi = e^{S/\alpha}$, and S is expanded into a series according to powers of α . In the WKP approximation the quantum effect of the reflection in a potential barrier is completely missing. Therefore an other method must be employed for the determination of the reflected wave. By means of the transformation

$\psi = y/\sqrt{k}$ the first mentioned equation takes the form $(d^2y/dt^2) + (1 + \alpha^2 q(\alpha t))y = 0$. To this equation the operation of the scattering in a continuous spectrum is formally applied. All terms of the scattering series have the same order with regard to α . The problem is the computation of the amplitude of the transition from the eigenstate of the Hamiltonian

$H_0 = d^2/dt^2$ with the momentum 1 to the state with the momentum -1. This amplitude is expressed by a well-known series from perturbation theory. Subsequently the terms occurring in this expression are examined separately. The process of computation is pursued step by step. In the case of

Card 2/3

Superbarrier Reflection in Quasi-Classical Approximation 197/56-34-5-32/61

an arbitrary form of the potential for the main part of the reflection coefficient

$$R = -ie^{2i\tau_0/\alpha} = -i \exp\left\{\frac{2i}{\alpha} \int_0^{\xi_0} k d\right\} \quad \text{is found.}$$

The last paragraph investigates the limits of applicability of this formula. The authors investigated the restrictions of the domain of the parameters. There are 5 references, 4 of which are Soviet.

ASSOCIATION: Institut radiofiziki i elektroniki Sibirskogo otdeleniya Akademii nauk SSSR (Institute of Radiophysics and Electronics at the Siberian Department of the AS USSR)

SUBMITTED: December 14, 1957 (initially), January 26, 1958 (after revision)

1. Wave analysis--Theory
2. Perturbation theory--Theory
3. Mathematics--Theory

Card 3/3

SOV/56-34-6-33/51

AUTHORS: Pokrovskiy, V. L., Ulinich, F. R., Savvinykh, S. K.

TITLE: The Superbarrier Reflection in Quasiclassical Approximation. II
(Nadbar'yernoye otrazheniye v kvaziklassicheskom priblizhenii)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1958,
Vol. 34, Nr 6, pp. 1629-1631 (USSR)

ABSTRACT: This paper obtains an asymptotic expression for the amplitude of the superbarrier reflection under the conditions $k_0 a \gg 1$ and $k_0 a(E - U_0)/U_0 \gg 1$. The denotations used in this paper were explained already in part I of this investigation (Ref 1). The form of this expression essentially depends on the type of the singularity of the potential. This paper investigates only two important special cases: the poles of the first and second order. The reflection amplitude is expanded into a series. L. I. Shiff (Ref 3) and D. S. Saxon (Sakson) (Ref 4) investigated the potential scattering of particles with high energies in the three-dimensional case under the conditions $\kappa/\alpha \simeq 1$, $\alpha \ll 1$. According to the results of this paper the method of the above mentioned authors cannot be applied to

Card 1/2

The Superbarrier Reflection in Quasiclassical Approximation. II

SOV/56-34-6-33/51

the scattering into large angles. Their results are equal to the results of this paper only for small κ/α , that is, in the region where the perturbation theory can be applied. There are 4 references, 2 of which are Soviet.

ASSOCIATION: Institut radiofiziki i elektroniki (Institute of Radio Physics and Electronics) Sibirskiy filial Akademii nauk SSSR (Siberian Branch, AS USSR)

SUBMITTED: January 31, 1958

Card 2/2

POKROVSKIY, V.^L; ULINICH, F.; SAVVINYKH, S.

Local reflection in wave guides of variable cross section. Dokl.
AN SSSR 120 no. 3:504-506 My '58. (MIRA 11:7)

1. Institut radiofiziki i elektroniki Zapadno-Sibirskogo filiala
AN SSSR. Predstavleno akademikom M.A. Leontovichem.
(Wave guides)

SOV/109-59-4-2-2/27
AUTHORS: Pokrovskiy, V.L., Ulinich, F.R., and Savvinykh, S.K.
TITLE: The Theory of Waveguides of Variable Cross-Section
(K teorii volnovodov peremennogo secheniya)
PERIODICAL: Radiotekhnika i Elektronika, 1959, Vol 4, Nr 2,
pp 161-171 (USSR)

ABSTRACT: The article considers the propagation of the electromagnetic waves in "plane" metallic waveguides of variable cross-section, without taking into account the loss in the walls. It is assumed that at very large distances the cross-sections of the waveguide are constant, though they may be different at various ends of the system. It is also assumed that the walls of the guide are inclined to the axis at a comparatively small angle. The problems of this type were investigated by a number of authors (Ref.1, 2 and 3) who employed the method of the eigen functions of plane diaphragms. This method has a number of disadvantages and, therefore, the aim of this work was to find a more satisfactory method. For the purpose of analysis, it is assumed that the waveguide is excited at its left-hand side terminal

Card 1/5

SOV/109-59-4-2-2/27

The Theory of Waveguides of Variable Cross-Section

and that its cross-section increases monotonically. The axis of the waveguide is z and the fields are dependent on co-ordinates y and z . The boundaries of the waveguide are determined by:

$$y = \pm f(\alpha z) \quad (1)$$

where α is a small parameter. New co-ordinates η and ξ are introduced so that the lines $\eta = \pm 1$ coincide with the boundaries of the waveguide while the lines $\xi = \text{const}$ are orthogonal to the lines $\eta = \text{const}$. Therefore, y can be written as Eq (2) while the lines orthogonal to $\eta = \text{const}$ are given by Eq (3). The parameter C of Eq (3) is expressed in terms of ξ by Eq (4). From Eq (3) and Eq (4), ξ is expressed by Eq (5). The inverse transformation can be done by means of Eq (6) which are accurate to within α^2 . The Laplacian in η and ξ co-ordinates is in the form of Eq (9). The electro-magnetic field can be expressed by a vector-potential $\vec{A}$ which satisfies Eq (10) and Eq (11) and the boundary conditions expressed by Eq (12). The field vectors can be found from Eq (13). The waves of the electric type

Card 2/5

SOV/109-59-4-2-2/27

The Theory of Waveguides of Variable Cross-Section

can be determined from Eq (15) where U is a scalar potential given by Eq (16). Similarly, the waves of the magnetic type can be found from Eq (17). If a new variable $\xi = \alpha \zeta$ is introduced, the operators L_0 and L_1 (see Eq (9)) are expressed by Eq (19). By employing the Wentzel-Kramers-Brillouin method (Ref 4) and the perturbation method, an expression in the form of Eq (20) is obtained, where β is a small parameter. This equation should satisfy the boundary conditions expressed by Eq (16) or Eq (18). The solution of the equation is in the form of Eq (21) so that Eq (20) leads to Eq (22). The zero approximation U_0 of Eq (21) is in the form of Eq (23). The amplitudes U_{n0} of Eq (23) can be found from Eq (24). The solution of this is given by Eq (26). For very large ξ , Eq (26) can be expressed by Eq (27). The function of the first approximation U_1 is given by Eq (29). The expressions for U_{n1} can be found from Eq (30) or Eq (34). The solution of these is in the form of Eq (35). For very large ξ , Eq (35) is either in the form of Eq (36) or Eq (37). The integrals in Eq (36) or

Card 3/5

SOV/109-59-4-2-2/27

The Theory of Waveguides of Variable Cross-Section

Eq (37) are in the form of the function given by Eq (38) and can be expanded into a power series of α . If only one wave having an index l propagates from the left-hand side terminal of the waveguide, the transmission coefficient D_l , the reflection coefficient R_l and the scatter coefficient S_{ln} are expressed by Eq (46). The formulae derived above are employed to analyse two special cases. If the waveguide is such that each boundary consists of three flat planes so that the function $f(\xi)$ is given by Eq (47), the reflection coefficient is expressed by Eq (48), while the scatter coefficient is given by Eq (50). For a waveguide whose boundaries are determined by the function defined by Eq (51), the reflection and the scatter coefficients are expressed by Eq (52). The above analysis shows that only the changes of the phase are substantially dependent on the form of the waveguide. On the other hand, the amplitudes are primarily determined by the "irregularities" of the waveguide junctions. The authors express their

Card 4/5

SOV/109-59-4-2-2/27

The Theory of Waveguides of Variable Cross-Section
gratitude to Yu.B.Rumer, V.A.Toponogov and A.I.Yel'kind
for valuable discussion. There is an appendix and
4 references of which 2 are Soviet and 2 English.

SUBMITTED: 20th July 1957

Card 5/5

16(1)

AUTHOR:

TITLE:

PERIODICAL:

ABSTRACT:

Pokrovskiy, V.L. (Novosibirsk)

SOV/39-48-3-1/5

On a Class of Polynomials With Optimum Properties

Matematicheskii sbornik, 1959, Vol 48, Nr 3, pp 257-276 (USSR)

The calculation of the optimally directed antennas in radio-technics leads to the following mathematical problem: Let the class $\mathcal{U}_n(z_0, R, \psi)$ of the polynomials $A_n(z)$ of degree n be considered, whereby 1) $|A_n(z)|$ attains the maximum value R

in $z_0 = e^{i\varphi_0}$ on the arc $(-\psi, \psi)$ of the unit circle ($z_0 =$

$= \frac{2\pi d}{\lambda} \cos \varphi_0$, where λ the wave length, d the distance of the radiators, φ_0 the direction of the maximum intensity);

2) there exist points $z_1 = e^{i\varphi_1}$, $z_2 = e^{i\varphi_2}$ ($-\psi < \varphi_1 < \varphi_0 < \varphi_2 < \psi$) in which $|A_n(z_1)| = |A_n(z_2)| = 1$, while on $(-\psi, \varphi_1)$ and

Card 1/ 4

On a Class of Polynomials With Optimum Properties SOV/39-48-3-1/5
 (φ_2, φ) it holds: $|A_n(z)| \leq 1$; 3) on (φ_1, φ_2) it is
 $|A_n(z)| \geq 1$. A polynomial $A_n^0(z)$ of the class $\mathcal{K}_n(z_0, R, \varphi)$
 is to be determined for which $|z_2 - z_1|$ has a minimum. Since
 the values of $|A_n(z)|$ are considered only on the unit circle,
 the author investigates the behavior of the functions

$$z^{-\frac{n}{2}} A_n(z) = \sum_{k=-\frac{n}{2}}^{\frac{n}{2}} a_k z^k \quad \text{and restricts himself to the case}$$

especially interesting for radiotechnics where the considered
 functions are real on the unit circle. By the conformal trans-

formation $x = i \frac{1-z}{1+z}$ the arc $(-\Psi, \Psi)$ is transferred into the
 interval $(-\operatorname{tg} \frac{\Psi}{2}, \operatorname{tg} \frac{\Psi}{2})$ of the real axis and the class

Card 2/4

On a Class of Polynomials With Optimum Properties

SOV/39-48-3-1/5

originally considered into the class $\mathcal{L}_n(c, R, a)$ of the functions of the type

$$B_n(x) = \frac{P_n(x)}{(1+x^2)^{n/2}},$$

where $P_n(x)$ is a polynomial of at most n -th degree. It is $a = \operatorname{tg} \frac{\psi}{2}$, c is the image of $z = z_0$, and a function $B_n^{(o)}(x)$ is sought for which $B - \alpha$ becomes minimum, where α and B are the images of z_1 and z_2 . Then the author investigates in detail the properties of the functions $B_n(x)$, whereby he distinguishes three different types; he proves that a uniquely determined function of the class possesses the required property. Functions of all the three types are constructed according to a method of Chebyshev [Ref 9]. Finally the dependence of the optimum functions $B_n^{(o)}(x)$ of a and c for given R is investigated. Altogether there are 12 theorems.

Card 3/4

On a Class of Polynomials With Optimum Properties

SOV/39-48-3-1/5

The author thanks N.I. Akhiezer for valuable suggestions and Yu.B. Rumer, A.I. Fet, P.P. Kufarev for discussions. There are 13 figures, and 10 references, 9 of which are Soviet, and 1 English.

SUBMITTED: September 26, 1957

Card 4/4

83187

S/056/60/039/002/024/044
B006/B056

24.4500

AUTHORS:

Dykhne, A. M., Pokrovskiy, V. L.

TITLE:

Change in the Adiabatic Invariant of Particles in a Magnetic Field. I

PERIODICAL:

Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960,
Vol. 39, No. 2(8), pp. 373-377

TEXT: Problems of the conservation of adiabatic invariants, especially of the magnetic moment, of particles in a magnetic field have repeatedly been investigated. In Ref. 3, Dykhne calculated the change in the adiabatic invariant of an oscillator whose frequency was a time function. The magnetic field was assumed to be homogeneous and variable with time. It was the purpose of the present paper to investigate the change in the adiabatic invariant in a spatially variable magnetic field. This spatial change was assumed to be small as compared to the Larmor radius (with $x \rightarrow +\infty$, $\vec{H} \rightarrow \vec{H}_0$). If the curvature of the lines of force is neglected, the treatment of the problem may be based on the model Hamiltonian

$H = (p_x^2 + p_y^2 + m^2 \omega^2(x) y^2) / 2m$, where $\omega(x)$ is the Larmor frequency. The

Card 1/3

83187

Change in the Adiabatic Invariant of Particles S/056/60/039/002/024/044
in a Magnetic Field. I B006/B056

small parameter of the problem is $\alpha = r_L \omega' / \omega$, where r_L is the Larmor radius. The Schrödinger equation belonging to this Hamiltonian is $\frac{1}{2m}(\Delta\psi - m^2\omega^2(x)y^2\psi) = -E\psi$. It is transformed into a system of orthogonal coordinates (ξ, η) , and the zero-th approximation $\left[m\omega\left(-\frac{\partial^2}{\partial\eta^2} - \eta^2\right) \right]$

$+ \sqrt{\omega} \frac{\partial}{\partial\xi} \left(\frac{1}{\sqrt{\omega}} \frac{\partial}{\partial\xi} \right) + 2mE \right] \psi = 0$ is investigated. In the following, the transition amplitudes are determined by perturbation-theoretical means. The off-diagonal elements of the oscillator matrix are obtained in the following way:

$$\begin{aligned} \langle n+2, E | L_1 | n, E \rangle &= \frac{3\pi}{16} \sqrt{(n+1)(n+2)} \exp \left\{ i q(\xi_0) - |\sigma(\xi_0)| \right\}; \\ \langle n-2, E | L_1 | n, E \rangle &= \frac{3\pi}{16} \sqrt{(n-1)n} \exp \left\{ -i q(\xi_0) - |\sigma(\xi_0)| \right\}. \end{aligned}$$

Thus, one finds the following relation for the change in the adiabatic invariant:

$$\frac{\Delta I}{I} = \left(\frac{3\pi}{8} \right) 2 \operatorname{Re} \left[-i \exp 2i \left\{ \int_0^{\xi_0} \frac{m\omega d\xi}{\sqrt{2m(E - I\omega)}} + \varphi_- \right\} \right].$$

In an appendix, the contribution to the elements of the scattering matrix due to second

Card 2/3

83187

Change in the Adiabatic Invariant of Particles in a Magnetic Field. I S/056/60/039/002/024/044
B006/B056

approximation, is estimated. L. D. Landau and Ye. M. Lifshits are mentioned. There are 7 references: 5 Soviet and 1 US.

ASSOCIATION: Institut radiofiziki i elektroniki Sibirskogo otdeleniya
Akademii nauk SSSR
(Institute of Radiophysics and Electronics of the Siberian
Branch of the Academy of Sciences USSR)

SUBMITTED: February 25, 1960

4

Card 3/3

POKROVSKIY, V.L.; DYKHNE, A.M.

Decay of acoustic excitations in crystals. Zhur. eksp. i teor.
fiz. 39 no.3:720-725 S '60. (MIRA 13:10)

1. Institut radiofiziki i elektroniki Sibirskogo otdeleniya
Akademii nauk SSSR. (Lattice theory)

S/056/61/040/001/015/037
B102/B204

24.2140 (1072, 1160, 1395)

AUTHOR: Pokrovskiy, V. L.

TITLE: Threshold phenomena in a superconductor

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 40,
no. 1, 1961, 143-151

TEXT: The decay of elementary excitations in a superconductor differs from that in a normal metal by a number of peculiarities, above all the existence of a decay threshold. Such events as the decay of a phonon in an electron-hole pair, the excitation of a phonon on the Fermi surface by an electron (hole) etc., are possible in a superconductor only from certain threshold excitation energies onward, which is connected with the existence of a gap Δ in the electron energy spectrum. Thus, the decay of a phonon into an electron-hole pair is possible only for phonons with an energy of $\omega > 2\Delta$, the pair production by an electron only at energies of $\epsilon > 3\Delta$. The threshold energy of an electron for all these processes is very near the beginning of the spectrum, at a distance of the order of $c^2\Delta/v_F^2$. From the experimental

Card 1/4

89209

S/056/61/040/001/015/037
B102/B204

Threshold phenomena in a...

point of view, the threshold $\omega_{th} = 2\Delta$ of the phonon decay is the most interesting, below which (at absolute zero) no ultrasonic absorption occurs ($\omega_{th} \sim 10^{10} - 10^{11} \text{ sec}^{-1}$). In the present paper these phenomena near the threshold are theoretically studied. Analogous studies by G. M. Eliashberg and A. B. Migdal are briefly discussed. First, using the Fröhlich Hamiltonian in the notation used by Migdal, the Dyson system of equations for the functions D, G and F which describe phonons and electrons in the superconductive state, are given and studied. This system turns out to be equivalent to that given by S. T. Belyayev, which describes the interaction of Bose particles below the point of condensation. The conclusions to be drawn from the weak-coupling approximation are studied; the results of this approximation hold within the region $\lambda_0 \sim 1$ (N. N. Bogolyubov's theory assumes $\lambda_0 \ll 1$). Furthermore, ultrasonic damping, i.e., the decay of a phonon into an electron-hole pair is studied. For the phonon polarization operator $\Pi(q, \omega)$ an expression is derived, and for the damping near the threshold, $\text{Im } \omega_q = -\frac{\lambda_0 \tau^2}{4} \frac{\Delta}{p_0 q} \omega_q = -\frac{\lambda_0 \tau^2}{4} \frac{\Delta}{\sqrt{M}}$ is obtained; at $\omega_q = 2\Delta$,

Card 2/4

89209

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B102/B204

Threshold phenomena in a...

$\text{Im } \omega_q / \omega_q \sim 1/\sqrt{M} \sim 10^{-2}$. Near the threshold $\text{Re } \Pi$ has a logarithmic singularity of the form $(\Delta/4q) \ln[(2\Delta - \omega)/\omega_0]$. If $\omega \gg 2\Delta$, one may put $\Delta = 0$, and $\text{Im } \Pi(q, \omega) = \hbar\omega/4\pi q$, a result, which is equal to that obtained by Migdal. In the following the author studies the damping of electron excitations, i.e., the phonon emission; for this purpose, $\text{Im } \Sigma_1(p, \eta)$, is calculated, where $\Sigma_1(p, \eta)$ is described as "free energy" of the electron, and three limiting cases are studied. In the case $\eta \gg \Delta$, the formula obtained goes over into that obtained for normal metals. Finally, the production of an electron-hole pair by an electron is studied; the threshold of this process is at about $\eta = 3\Delta$. The equation obtained for $\text{Im } \Sigma_1(p, \eta)$ is discussed and compared with the results obtained by Migdal. The author finally thanks A. P. Kazantsev for valuable remarks. L. P. Gor'kov and L. P. Pitayevskiy are mentioned. There are 7 Soviet-bloc references.

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Card 3/4

89209

S/056/61/040/001/015/037
B102/B204

Threshold phenomena in a...

SUBMITTED: May 27, 1960

Card 4/4

24,2140 (1072, 1160, 1395)

24 1700

1043, 1136, 1151, 1055

S/056/61/040/002/038/047
B102/B201

AUTHOR:

Pokrovskiy, V. L.

TITLE:

Thermodynamics of anisotropic superconductors

PERIODICAL:

Zhurnal eksperimental'noy i teoreticheskoy fiziki,
v. 40, no. 2, 1961, 641-645

TEXT: A theory of superconductivity has so far been developed only for isotropic substances, which, while showing good agreement with experiments, diverges, however, in the quantitative respect. Thus, e.g., the theory gives a value of 1.4 for the jump of specific heats in the critical point for all superconductors; actually, however, this value differs from one metal to another. Some experiments indicate that the energy gap in some superconductors is clearly anisotropic. Therefore, the authors developed a theory for anisotropic superconductors on the basis of the equation by N. N. Bogolyubov for the energy gap at absolute zero:

$$\Delta(\vec{p}) = g \left\{ U(\vec{p}, \vec{p}') \frac{\Delta(\vec{p}')}{\epsilon(\vec{p}')} d^3 p' \right\}, \text{ where } g \text{ is a dimensionless coupling}$$

Card 1/6

S/056/61/040/002/038/047
B102/B201

Thermodynamics of anisotropic ...

constant, $U(\vec{p}, \vec{p}')$ the interaction function of two electron pairs with antiparallel momenta and spins, $\varepsilon(\vec{p}) = \sqrt{\xi^2(\vec{p}) + \Delta^2(\vec{p})}$, where $\xi(\vec{p}) =$

$= \vec{v}_F(\vec{p} - \vec{p}_F)$, $\vec{v}_F$ and $\vec{p}_F$ are rate and momentum on the Fermi surface.

Integration after ξ gives $\Delta(\vec{n}) = g \int U(\vec{n}, \vec{n}') \Delta(\vec{n}') \ln \frac{2\omega}{\Delta(\vec{n}')} \frac{d\sigma'}{v_F'} \quad (2),$

where $d\sigma'$ is a surface element on the Fermi surface, ω is the Debye frequency, $\vec{n} = \vec{p}/p$, $\vec{n}' = \vec{p}'/p'$. If one considers that $g \ll 1$, one may

formulate the solution ansatz for (2) as $\Delta(\vec{n}) = 2\omega \varphi(\vec{n}) e^{-\Lambda/g}$, where $\varphi(\vec{n})$ is a dimensionless function, and Λ a constant of the order of one.

One thus obtains in first approximation $\varphi(\vec{n}) = \Lambda \int U(\vec{n}, \vec{n}') \varphi(\vec{n}') \frac{d\sigma'}{v_F'}$

a homogeneous integral equation of the Fredholm type, the kernel of which can be symmetrized easily. Denoting by $\psi(\vec{n})$ its normalized solution (corresponding to the minimum eigenvalue), $\varphi(\vec{n}) = Q\psi(\vec{n})$. Q is found from

Card 2/6

S/056/61/040/002/038/047
B102/B201

Thermodynamics of anisotropic ...

$$\varphi_1(n) = \Lambda \int U(n, n') \varphi_1(n') \frac{d\sigma'}{v_F} - gQ \int U(n, n') \psi(n') \ln(Q\psi(n')) \frac{d\sigma'}{v_F} \quad (5)$$

with $\int \psi^2(\vec{n}) \ln(Q\psi(\vec{n})) d\sigma / v_F = 0$ and $\int \psi^2(\vec{n}) d\sigma / p_0 v_F = 1$ to be $Q = \exp\{-\int \psi^2(\vec{n}) \ln \psi(\vec{n}) d\sigma / p_0 v_F\}$, where p_0 is a quantity of the order of a Fermi limit momentum. If $\omega = \text{const}$ one obtains with constant temperature

$$\Delta(p) = g \int U(p, p') \frac{\Delta(p')}{\varepsilon(p')} [1 - 2f(\beta\varepsilon(p'))] d^3p', \quad (10)$$

where $f(x) = (e^x + 1)^{-1}$, and

$$\Delta(n) = g \int U(n, n') \left[\ln \frac{2\omega}{\Delta(n')} - F(\beta\Delta(n')) \right] \frac{d\sigma'}{v_F}, \quad (11)$$

Card 3/6

S/056/61/040/002/038/047
B102/B201

Thermodynamics of anisotropic ...

$$F(x) = \int_{-\infty}^{\infty} dy (y^2 + 1)^{-1/2} f(x \sqrt{y^2 + 1}). \quad (12)$$

on the Fermi surface. From (10) and (12) one obtains

$$\Delta(n) = g \int U(n, n') \Delta(n') \left[\ln 2\omega \beta \frac{\gamma}{\pi} - \lambda (\beta \Delta(n'))^2 \right] \frac{d\sigma'}{v_F}, \quad (15) \quad (15),$$

where $T_K = (\gamma/\pi) 2\omega e^{-\lambda/g}$. $\ln \gamma$ = Euler's constant.

$$Q^2 = A \frac{T_K - T}{T_K}, \quad A = \left[\lambda \left(\frac{\pi}{\gamma} \right)^2 \int \psi^4(n) \frac{d\sigma}{\rho_0 v_F} \right]^{-1}. \quad (17) \quad (17),$$

furthermore, near the critical point. The manner in which the anisotropy of the superconductor influences its specific heat is studied.

$$C_s(T) = \frac{2T_K}{(2\pi)^3} \int \frac{d\sigma}{v_F} \left(\frac{\pi^2}{3} + \frac{\pi^2 A}{2\gamma^2} \psi^2 \right). \quad (21) \quad (21),$$

Card 4/6

S/056/61/040/002/038/047
B102/B201

Thermodynamics of anisotropic ...

which holds near the critical point, is obtained by a short calculation; the jump is defined by $\Delta C/C_n(T_K) = 3A/2\gamma^2$. The ratio of the A value of the isotropic model to the A value from (17) is $A_{is}/A = \int d\phi^4(\vec{n})/p_0 v_F$. A comparison of theoretical results with experimental ones is, however, satisfactory in part. χ from the relation $H_K(T)/H_K(0) = 1 - \chi(T/T_K)^2$ is found to be $\chi > \chi_{is} = 1.06$; experimentally, however, it is near unity (with the exception of Sn, where $\chi = 1.07$). The jump $\Delta C/C_n(T_K)$ is found to be >1.4 , likewise more than in the isotropic case. The subscript K denotes the values in the critical point. A. A. Abrikosov, L. P. Gor'kov, and I. M. Khalatnikov are mentioned. There are 9 references: 6 Soviet-bloc and 3 non-Soviet-bloc. The most recent reference to English-language publications reads as follows: H. A. Boorse, Phys. Rev. Lett. 2, 391, 1959.

Card 5/6

Thermodynamics of anisotropic ...

S/056/61/040/002/038/047
B102/B201

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SUBMITTED: September 13, 1960

Card 6/6

94.2140 (1055, 1072, 1469)

S/056/61/040/003/023/031
B113/B202

AUTHOR: Pokrovskiy, V. L.

TITLE: Ultrasonic absorption in an anisotropic superconductor

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 40,
no. 3, 1961, 898-906

TEXT: The anisotropy of superconductors is considered within the framework of the method by L. P. Gor'kov (Ref.1: ZhETF, 34, 735, 1958). The author demonstrates that formula $\alpha_s/\alpha_n = 2f(\beta\Delta)$, $f(x) = (e^x + 1)^{-1}$, $\beta = 1/T$, where α_s, α_n are the decrements of ultra-sound in the superconducting and normal state, which has been derived by Bardin, Cooper, and Shriver is incorrect in the anisotropic case. According to Matsubara (Ref.8: Progr.Theor.Phys., 14, 351, 1955) Green's function of phonons is introduced which is given by

$$D_{ss'}(q, \tau - \tau') = i \langle T b_s(q, \tau) b_{s'}^+(q, \tau') \rangle \beta_s(p) \beta_{s'}(q), \quad (4)$$

where $\langle A \rangle = \text{Sp}(e^{-\beta(H - \mu N)} \cdot A)$ and $b_s(\vec{p}, \tau) = e^{\tau H} b_s(\vec{p}) e^{-\tau H}$,
Card 1/8

22143

S/056/61/040/003/023/031
B113/B202

Ultrasonic absorption in an...

$b_s^+(\vec{p}, \tau) = e^{\tau H} b_s^+(\vec{p}) e^{-\tau H}$. In the case of a superconductor the electrons are described by two Green functions G and F according to Gor'kov (see above) having the form

$$G(p, \tau - \tau') = i \langle T_\tau a(p, \tau) a^\dagger(p, \tau') \rangle g_0(p), \quad (5)$$

$$F(p, \tau - \tau') = \langle N | e^{H(\tau - \tau')} T a^\dagger(p, \tau) a^\dagger(-p, \tau') | N + 2 \rangle g_0(p). \quad (6)$$

In (6) $\langle N |$, $|N + 2 \rangle$ are microcanonic states with the particle numbers N and $N + 2$ according to the given temperature. The author then passes from the representation of the functions D, G, F , (4), (5), (6) with respect to time to the representation of the "imaginary frequency". To construct the functions $D_{ss}(\vec{q}, i\omega_n)$, $G(\vec{p}, i\eta_n)$, $F(\vec{p}, i\eta_n)$ the author employs the graphical method in which Green's zero functions

$$D_{ss}^0 = \delta_{ss} D_s, \quad D_s(\vec{q}, i\omega_n) = 2\beta_s^2(\vec{q}) \omega_s^2(\vec{q}) / [\omega_s^2(\vec{q}) + \omega_n^2], \quad (7)$$

$$G^0(p, i\eta_n) = g_0(p) / (\xi_p^0 - i\eta_n), \quad (8)$$

$$F^0(p, i\eta_n) = 0. \quad (9)$$

correspond to the lines, with $\vec{p} = \vec{v}_F^0(\vec{n})(\vec{p} - \vec{p}_F)$. In this case, $\vec{v}_F$ depends

Card. 2/8

22143

S/056/61/040/003/023/031
B113/B202

Ultrasonic absorption in an...

on the direction. When introducing the polarization operator which in this case is independent of r, r' (i.e.: $\Pi_{rr'} = \Pi$) and after solving the set of equations with respect to $D_{ss'}$, the author obtains $D_{ss'} = \delta_{ss'} D_s + D_s D_{s'} \Pi / (1 - D \Pi)$, $D = \sum_s D_s$. The exact solutions of the Dyson equations for D, G, F which were set up by Pokrovskiy (Ref.11: ZhETF, 40, 143, 1961) are no longer considered since only ultrasonic attenuation is concerned. Hence, only such properties of G and F are given as are necessary for the investigation. The Dyson equations for G and F are given by

$$G(p) = G_0(p) + [G_0(p) \Sigma_1(p) G(p) - G_0(p) \Sigma_2(p) F(p)] g_0^{-1}(p), \quad (15)$$

$$F(p) = [G_0(-p) \Sigma_1(-p) F(p) + G_0(-p) \Sigma_2(p) G(p)] g_0^{-1}(p), \quad (16)$$

where p is the four-vector $(\vec{p}, i\eta_n)$ and Σ_1, Σ_2 the operators of the "energy proper". $\Sigma_1(p)$ in this case has the same value as in an ordinary metal. It is almost independent of T for the values of T (lower than the production temperature) so that it can be replaced by the value at zero

Card 3/8

22143

S/056/61/040/003/023/031
B113/B202

Ultrasonic absorption in an...

temperature. Considering $G_M(p) = G_0(p) [1 - g_0^{-1}(p) G_0(p) \Sigma_1(p)]^{-1}$. (17)
and $\varphi(\eta) = \xi_p^0$ whose roots constitute the energy of the electron in the
superconductor and whose solution is designated by ξ_p , equation

$$G(p, \eta) = \left(\frac{u_p^2}{\epsilon_p - \eta} - \frac{v_p^2}{\epsilon_p + \eta} \right) g(p) + A(p, \eta), \quad (23)$$

$$F(p, \eta) = \frac{\Delta(p)}{2\epsilon_p} \left(\frac{1}{\epsilon_p - \eta} + \frac{1}{\epsilon_p + \eta} \right) g(p) + B(p, \eta).$$

is obtained after the solution of the set of equations (15), (16). It can
be seen from a study of the function $\Pi(p, i\omega_n)$ having the graph (Fig.2)

and for which $\Pi(q, i\omega_n) = \frac{T}{(2\pi)^3} \sum_{n_1} \int d^3p [G(p) G(p-q) - F(p) F(p-q)]. \quad (24)$

holds that the equation $1 - D\Pi = 0$ which determines the dispersion of ultra-
sound takes the form

$$\frac{\pi^2}{\rho_0} \sum_s \frac{\lambda_s(n) \omega_s^{02}(q)}{\omega_s^{02}(q) - \omega^2} = \frac{1}{\text{Re } \Pi} - i \frac{\text{Im } \Pi}{(\text{Re } \Pi)^2}. \quad (34)$$

Card 4/8

22113

S/056/61/040/003/023/031
B113/B202

Ultrasonic absorption in an...

The first term of the right side of (34) leads to a finite renormalization of the sound velocity, the second term causes the attenuation of sound. Since attenuation is only low it can be written in form

$$\alpha_s(q) = \text{Im } \omega_s(q) = v_s(n) \omega_s(q) \text{Im } \Pi, \quad (35)$$

where $v_s(\vec{n})$ is any experimentally not measured direction function. This form shows that the attenuation is distinctly anisotropic. When considering the ratio between the sound attenuation in the superconductor and the corresponding quantity $\alpha_n(\vec{q})$ in ordinary metal, $v_s(\vec{n})$ can be excluded. The formula for $\alpha_n(\vec{q})$ coincides with the above formula for $\alpha_s(\vec{q})$ if in

$$\text{Im } \Pi = \frac{2}{(2\pi)^2} \frac{\omega}{q} \int \frac{ds}{v_F} f(\beta\Delta) g^2(n) \delta(\cos \chi). \quad (33)$$

$f(\beta\Delta)$ is assumed to be 1/2. Formula

$$\frac{\alpha_s}{\alpha_n} = 2 \langle f(\beta\Delta) \rangle_n, \quad \langle \varphi \rangle_n = \int \frac{ds'}{v_F} g^2(n') \delta(\cos \chi) \varphi(n') / \int \frac{ds'}{v_F} g^2(n') \delta(\cos \chi). \quad (36)$$

which is analogous to $\alpha_s/\alpha_n = 2f(\beta\Delta)$, $f(x) = (e^x + 1)^{-1}$, $\beta = 1/T$ is obtained

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Card 5/8

22113
S/056/61/040/003/023/031
B113/B202

Ultrasonic absorption in an...

for the anisotropic case. The second not measured function $g^2(\vec{n})$ appearing in (36) does not permit conclusions as to the energy gap $\Delta(\vec{n})$. The last chapter of this paper deals with the absorption of ultra-sound in the low-temperature range. The authors consider a range of low temperatures $\beta\Delta \ll 1$. In

$$\text{Im } \Pi = \frac{1}{(2\pi)^2} \int d^3 p g^2(p) \frac{\vec{p}^2}{\epsilon^2} [f(\beta\epsilon - \beta\omega) - f(\beta\epsilon)] \delta(\epsilon - \epsilon' - \omega). \quad (29)$$

an integration can be made over $\vec{p}$ and

$$\text{Im } \Pi = \frac{\beta\omega c^2}{(2\pi)^2 q} \int \frac{d\chi}{v_F^4} \frac{g^2 \Delta}{|\cos^3 \chi|} \exp \left[-\beta\Delta \left(1 - \frac{c^2}{v_F^2 \cos^2 \chi} \right)^{-1/2} \right]. \quad (37)$$

is obtained. In this case integration does not cover the range $\cos \chi < c/v_F$ where c is the sound velocity and v_F the velocity of the electron on the Fermi surface. The amount of I_0 in $\text{Im } \Pi$ (37) is determined from

$$I_0 = \frac{g^2}{4\pi\rho} \frac{\omega}{q} \frac{c^2}{K v_F^4} \frac{1}{|\cos^3 \chi_0|} \exp \left[-\beta\Delta_0 \left(1 - \frac{c^2}{v_F^2 \cos^2 \chi} \right)^{-1/2} \right],$$

$$\rho\Delta_0 = \frac{\partial^2 \Delta}{\partial (\cos \chi)^2 \partial \varphi^2} - \left(\frac{\partial^2 \Delta}{\partial (\cos \chi) \partial \varphi} \right)^2. \quad (39).$$

Card 6/8

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S/056/61/040/003/023/031
B113/B202

Ultrasonic absorption in an...

The amount I_1 in $\text{Im}\Pi$ then has the form

$$I_1 = \frac{1}{4\pi} \frac{\omega}{\sqrt{2\epsilon_0}} \frac{g^2}{q} (\beta\Delta_0)^{-1/2} \exp(-\beta\Delta^{(n)}), \quad (43)$$

In this case $\Delta^{(n)}$ is a minimum value on the periphery $\cos\chi = 0$, perpendicular to the direction n , Δ_0 is the value of the derivative $\partial^2\Delta/\partial\varphi^2$ at the point of the minimum on the periphery.

$$I_1/I_0 \approx (v^2/c^2 \sqrt{\beta\Delta}) \exp\{-\beta(\Delta^{(n)} - \Delta_0)\}. \quad (44)$$

is obtained from (39) and (43). Two limiting cases were considered.

(1) $I_1/I_0 \gg 1$ in (44). For the majority of the pure superconductors only this case can be experimentally studied at present.

$$\alpha_s \sim \omega_s(q) \sqrt{T/T_n} \exp(-\Delta^{(n)}/T). \quad (45)$$

is obtained from (35) and (43). (2) $I_1/I_0 \ll 1$ in (44).

$$\alpha_s(q) = A v_s(n) \omega_s(q) (c/v_F)^2 e^{-\beta\Delta} \sum |\cos^2 \chi_0|^{-1}, \quad (47)$$

Card 7/8

22143

S/056/61/040/003/023/031
B113/B202

Ultrasonic absorption in an...

is obtained from (35) and (43) where λ is the angle between the direction and the velocity at the point of the minimum Δ and A a constant of the order of 1. A. B. Migdal and I. M. Khalatnikov are mentioned. There are 2 figures and 14 references: 10 Soviet-bloc and 4 non-Soviet-bloc. The 4 references to English-language publications read as follows: H. A. Boorse. Phys. Rev. Lett., 2, 391, 1959. R. W. Morse, T. Olsen, J. D. Cavenda. Phys. Rev. Lett., 3, 15, 193, 1959. H. Fröhlich. Phys. Rev., 79, 845, 1950. T. Matsubara. Progr. Theor. Phys., 14, 351, 1955.

ASSOCIATION: Institut radiofiziki i elektroniki Sibirskogo otdeleniya Akademii nauk SSSR (Institute of Radiophysics and Electronics, Siberian Department of the Academy of Sciences USSR)

SUBMITTED: October 10, 1960



Рис. 2

Card 8/8

POKROVSKIY, V.L.; TOPONOGOV, V.A.

Restoring the energy gap in a superconductor with the aid of
sound attenuation measurements. Zhur. eksp. i teor. fiz. 40
no.4:1112-1114 Ap '61. (MIRA 14:7)

1. Institut radiofiziki i elektroniki Sibirskogo otdeleniya
AN SSSR.

(Fermi surfaces) (Superconductivity)

POKROVSKIY, V.L.; KHALATNIKOV, I.M.

Superbarrier reflection of high-energy particles. Zhur. eksp.
i teor. fiz. 40 no.6:1713-1719 Je '61. (MIRA 14:8)

1. Institut fizicheskikh problem AN SSSR.
(Particles (Nuclear physics))

25205

S/056/61/040/006/026/031

B125/B202

24.2/40

AUTHORS: Pokrovskiy, V. L., Ryvkin, M. S.

TITLE: Influence of anisotropy on threshold phenomena in superconductors

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 40, no. 6, 1961, 1859-1864

TEXT: The authors studied absorption of ultrasonics and electromagnetic waves in anisotropic superconductors at 0°K near the threshold frequency ($\omega \sim 10^{11}$ to 10^{12} sec⁻¹). They demonstrate that the threshold frequency depends on the propagation direction of the waves. The excitation of sound oscillations in a strongly non-isothermal plasma without magnetic field has been studied by G. V. Gordeyev, ZhETF, 27, 19, 24, 1954. The laws of conservation of energy and momentum in the absorption of a phonon (or photon) connected with the decay of a Cooper pair reads as follows (notations by V. L. Pokrovskiy (ZhETF, 40, 898, 1961)):

$$\vec{\epsilon}(\vec{p}, \vec{q}) = \epsilon_{\vec{p}} + \epsilon_{\vec{p}-\vec{q}} = \sqrt{\left(\frac{2}{p} + \Delta\right)^2} + \sqrt{\left(\frac{2}{p} - \vec{q}\right)^2 + \Delta^2} \quad (1)$$

Card 1/7

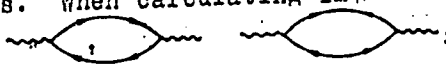
25205

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B125/B202

Influence of anisotropy on ...

The anisotropy of a superconductor changes the frequency dependence of absorption for the following two reasons: 1) in the anisotropic superconductors the minimum of the left-hand side of (1) is attained at certain points of the Fermi surface. 2) In the electromagnetic case the decay probability strongly increases with a decrease in the region of the allowed pair decay. Absorption of ultrasonics is calculated by using graphs. For calculating the absorption it is sufficient to calculate the imaginary part of the polarization operator $\Pi(\vec{q}, \omega)$ in the weak-coupling approximation. The results thus obtained qualitatively also hold for the strong coupling in superconductors. When calculating $\text{Im}\Pi$ the following two graphs must be considered



$$\text{Then } \text{Im}\Pi(\vec{q}, \omega) \sim \int d^3p \left[u^2 v'^2 + \frac{\Delta \Delta'}{4ee'} \right] g^2 g'^2 \delta(e + e' - \omega), \quad (2)$$

holds up to numerical factors. The dimensionless function $g = g(\vec{p})$ characterizes the anisotropy of the electron-phonon interaction. With $q \ll p_0$, $\Delta \sim \Delta'$, $g' \sim g$ holds from which in turn

$$\text{Im}\Pi(\vec{q}, \omega) \sim \iint g^4 \frac{\sin \theta d\theta d\varphi}{Kv} \int_{-\infty}^{\infty} d\xi \left[\left(1 + \frac{\xi}{e}\right) \left(1 - \frac{\xi'}{e'}\right) + \frac{\Delta^2}{ee'} \right] \delta(e + e' - \omega) (4)$$

Card 2/7

25205

S/056/61/040/006/026/031

B125/B202

Influence of anisotropy on ...

follows, where $K(\theta, \varphi)$ is the Gauss' curvature of the Fermi surface.

$$\text{Im} \Pi(q, \omega) \sim \iint \frac{\sin \theta d\theta d\varphi}{Kv} g^4 \frac{(\xi_1 + \varepsilon_1)(\xi_2 + \varepsilon_2) + \Delta^2}{\xi_1 \varepsilon_2 - \xi_2 \varepsilon_1} \quad (9)$$

is obtained after integration over $\{$. Near the threshold $\omega^2 = \Omega_0^2(1+\alpha)$, $\alpha \ll 1$ (15) can be written. In approximation to the terms $\sim \alpha^{1/2} \text{Im} \Pi$

$$= A c (\omega - \Omega_0)^{1/2} / v_0, A \sim g_0^4 / K_0 v_0 \Omega_0^{1/2} \quad (17) \text{ holds. } \alpha_s(\vec{n}) = \gamma(\vec{n}) \omega \text{Im} \Pi \quad (18)$$

holds for the attenuation of ultrasonics where $\gamma(\vec{n})$ is a certain experimentally not measurable function of direction. For this reason

$$\alpha_s(\vec{n}) = B(\vec{n}) c (\omega - \Omega_0)^{1/2} v_0, B(\vec{n}) = \gamma(\vec{n}) A \Omega_0 \quad (19) \text{ holds near the}$$

threshold value. In the isotropic case the minimum of $\Omega^2(\theta, \varphi)$ is attained on the whole line $\theta = \pi/2$. The absorption of the electromagnetic waves is determined by the imaginary part of the polarization tensor:

$\Pi_{\alpha\beta}$. If the above graphs are considered only

$$\text{Im} \Pi_{\alpha\beta} \sim \int d^3 p v_\alpha v_\beta \left[u^2 v'^2 + v^2 u'^2 - \frac{\Delta \Delta'}{2\varepsilon \varepsilon'} \right] \delta(\varepsilon + \varepsilon' - \omega). \quad (20)$$

Card 3/7

25205

S/056/61/040/006/026/031

B125/B202

Influence of anisotropy on ...

holds up to numerical factors. In the following

$$\text{Im } \Pi_{\alpha\beta} \sim \iint \frac{\sin \theta d\theta d\varphi}{Kv} v_{\alpha} v_{\beta} \frac{e_1 e_2 + \xi_1 \xi_2 - \Delta^2}{\xi_1 e_2 - \xi_2 e_1} \quad (23)$$

is obtained. The integral (23) depends mainly on the type of the metal.

$$\text{Im } \Pi_{\alpha\beta} \sim \frac{v_{\alpha 0} v_{\beta 0}}{K_0 v_0} \frac{\Delta_0}{v_0 q} \left[\alpha^{1/2} + 3a_1^2 \left(\frac{\Delta_0}{v_0 q} \right)^2 \alpha^{1/2} \right], \quad (26)$$

where $v_{\alpha 0}$, $v_{\beta 0}$ hold for a Pippard metal up to the lowermost powers of α and $\Delta_0/v_0 q$. Thus, two frequency ranges which are close to the threshold range exist in a Pippard metal: 1) with $\alpha \gg (\Delta_0/v_0 q)^2$

$$\text{Im } \Pi_{\alpha\beta} = A_1 (\Delta_0/v_0 q) (\omega - \Omega_0)^{1/2}, \quad A_1 \sim v_{\alpha 0} v_{\beta 0} / K_0 v_0 \Omega_0^{1/2}. \quad (27)$$

holds and with $\alpha \ll (\Delta_0/v_0 q)^2$

$$\text{Im } \Pi_{\alpha\beta} = A_2 (\Delta_0/v_0 q)^3 (\omega - \Omega_0)^{1/2}, \quad A_2 = 3A_1 a_1^2 \Omega_0. \quad (28)$$

holds. In the range 1 absorption is reduced by anisotropy, in range 2, however, it is increased. Due to the averaging in (26) the additional small factor $\sqrt{\alpha}$ occurs. In the corresponding experiments the

Card 4/7

25205

S/056/61/040/006/026/031

B125/B202

Influence of anisotropy on ...

experimentally measurable absorption must be $\sim \alpha^2$. b) With the London metal ($vq \ll \Delta$) the minimum point $\Omega^2(x, \varphi)$ exactly agrees with the point of the absolute minimum of the energy gap $\Delta(x, \varphi)$. Then

$$\omega^2 - \Omega^2(x, \varphi) = 4\Delta_m^2 [\alpha - a_2(x - x_0)^2 - b_2(\varphi - \varphi_0)^2] \geq 0 \quad \text{and} \quad \text{Im} \Pi_{\alpha\beta} \sim \frac{v_\alpha v_\beta}{K v_0} \left(\frac{v_0 q}{2\Delta_m} \right)^2 x_0^2 \alpha^{1/2}. \quad (30)$$

hold near the threshold. No additional small factors are obtained by averaging over the directions. In the experimentally most interesting case of the intermediary metal ($vq \sim \Delta$), $\Omega^2(x, \varphi)$ has a minimum at a certain point which is not on the line $x = 0$ and which does not agree with the minimum point of $\Delta(x, \varphi)$. In this case absorption near the threshold changes proportionally to $x_0^2 \alpha^{1/2}$, the factor $(v_0 q / 2\Delta_m)^2$ occurring in the formula for $\text{Im} \Pi_{\alpha\beta}$ instead of $(v_0 q / 2\Delta_m)^2$ in (30), however, is not small. A relatively small factor $\sqrt{\alpha}$ is obtained for the intermediary metals by averaging over the directions. The absorption in polycrystalline specimens of the intermediary metals is $\omega - 2\Delta_m$. The qualitative results in

Card 5/7

25205

S/056/61/040/006/026/031
B125/B202

Influence of anisotropy on ...

an isotropic model and in an anisotropic model with averaging are in agreement only with intermediary superconductors. At present no experiments have been made concerning the absorption of ultrasonics in the threshold range. The experimental points which are obtained from a single experiment concerning the frequency dependence of the absorption of electromagnetic waves near the threshold value (P. L. Richards and M. Tinkham, Phys.Rev., 119, 575, 1960) are not sufficient for comparison with theoretical data. The threshold frequencies of In, Hg, Pb measured by these authors were higher than those predicted by the theory of isotropy ($\Omega_0 = 3.5 \text{ kT}_c$). Exact experiments in the range near the threshold, with Pippard metals and single crystals are necessary. V. L. Pokrovskiy and V. A. Toponogov (ZhETF, 40, 1112, 1961) developed a method of determining the energy gap as a function of direction. The authors thank L. P. Gor'kov for his interest. There are 2 figures and 8 references: 5 Soviet-bloc and 3 non-Soviet-bloc. The two most recent references to English-language publications read as follows: D. C. Mattis, J. Bardeen, Phys. Rev., 111, 412, 1958. P.L. Richards, M. Tinkham. Phys. Rev., 119, 575, 1960.

Card 6/7

25205

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B125/B202

Influence of anisotropy on ...

ASSOCIATION: Institut radiofiziki i elektroniki Sibirskogo otdeleniya
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SUBMITTED: January 26, 1961

Card 7/7

S/020/61/138/003/013/017
B104/B205

9.1771

AUTHOR:

Pokrovskiy, V. L.

TITLE:

A general method of determining optimum distributions for linear antennas

PERIODICAL: Doklady Akademii nauk SSSR, v. 138, no. 3, 1961, 584 - 586

TEXT: An attempt has been made to establish a general method of determining the parameters of linear antennas, with the aid of which the optimum distribution of these parameters can be found by numerical calculation. The directional diagram $F(\cos \psi)$ of an antenna is assumed to depend on some parameters $\alpha_1, \alpha_2, \dots, \alpha_n$. For the sake of simplicity, a direction of $\psi = \pi/2$ is chosen for the main beam, and F is assumed to be an even function. The width of the main beam is indicated by ψ^* , and the relation $u^* = \cos \psi^*$ is introduced. $u_1 = \cos \psi_1$ corresponds to the minor lobes. Using these notations, one obtains the system $\partial F / \partial u|_{u_1} = 0$;

$F(u_1) = (-1)^i (1)$. If one of the minor lobes is directed along the
Card 1/4

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S/020/61/138/003/013/017

B104/B205

A general method of...

antenna ($u = 1$), Eq. (1) is supplemented by the equation $F(1) = (-1)^{n+1}$ (1'). It is demonstrated that the optimum choice of parameters is obtained from (1) or (1) and (1'). Thus, an optimum directional diagram has the maximum possible number of minor lobes which is $n-1$ or n if the system (1) is fully determined by $\alpha_1, \dots, \alpha_n$ values. Eqs. (1) or (1) and (1') in principle permit to find the optimum parameter values. This is illustrated by two simple examples: 1) an antenna consisting of four non-equidistant radiators of equal amplitudes and phases. The directional diagram of such antennas has the form $F(\cos \vartheta) = \frac{1}{2}(\cos x_1 u + \cos x_2 u)$ (4). Here, $u = \pi \cos \vartheta$; x_1 and x_2 denote the distance between the radiator and the middle of the antenna, expressed in units of a half wavelength. $F(0) = 1$ is used as a normalization. In this case, Eqs. (1) and (1') lead to

$$\cos x_1 u_1 + \cos x_2 u_1 = -2\mu,$$

$$x_1 \sin x_1 u_1 + x_2 \sin x_2 u_1 = 0, \quad (\mu = \frac{1}{R})$$

$$\cos x_1 \pi + \cos x_2 \pi = 2\mu. \quad (5)$$

Card 2/4

S/020/61/138/003/013/017
B104/B205

A general method of...

u_1 corresponds to the direction of one of the minor lobes, and the other is directed along the antenna. The solutions of (5) for three values of μ are graphically represented in Fig. 1. 2) An antenna with six radiators. In this case,

$$F = 1/3 (\cos x_1 u + \cos x_2 u + \cos x_3 u), \quad (6)$$

$$\sum_{i=1}^3 \cos x_i u_k = (-1)^k 3\mu \quad (k = 1, 2, 3); \quad (7)$$

$$\sum_{i=1}^3 x_i \sin x_i u_k = 0 \quad (k = 1, 2).$$

are valid, where $u_3 = \pi$. A numerical solution for $\mu = 0.13$ yields:
 $x_1 = 0.47$, $x_2 = 1.22$, $x_3 = 2.41$. The theory described here was supported by experiments of Yu. A. Vayner. N. N. Meyman is thanked for valuable advice, A. M. Dykhne, V. A. Toponogov, and Yu. A. Vayner for discussions, as well as M. G. Fadiyenko and T. M. Artemenok for numerical calculations.

Card 3/4

A general method of...

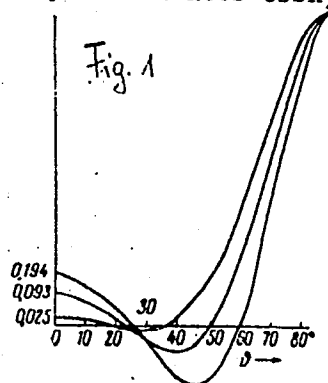
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B104/B205

There are 2 figures and 3 references: 1 Soviet-bloc and 2 non-Soviet-bloc.
The 2 references to English-language publications read as follows:
C. L. Dolph, Proc. IRE, 34, 335 (1946); H. J. Riblett, Proc. IRE, 35, 489 (1947).

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PRESENTED: February 2, 1961, by M. A. Leontovich,
Academician

SUBMITTED: January 30, 1961



Card 4/4

POKROVSKIY, V. L.

Dissertation defended for the degree of Doctor of Physicomathematical Sciences
at the Joint Scientific Council on Physicomathematical and Technical Sciences:
Siberian Branch 1962

"Anisotropy and Kinetics of Superconductors."

Vestnik Akad. Nauk, No. 4, 1963, pp 119-145

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S/109/62/007/006/005/024
D266/D308

9.1911

AUTHORS: Baklanov, Ye. V., Pokrovskiy, V. L. and Surdutovich,
G. I.

TITLE: Theory of unequally spaced linear antennas

PERIODICAL: Radiotekhnika i elektronika, v. 7, no. 6, 1962, 963-
972

TEXT: The purpose of the paper is to determine theoretically the conditions resulting in an optimum radiation pattern. A symmetrically placed linear array is considered consisting of $2n$ elements. The radiation pattern is obtained in the form

$$F_{2n}(u|I_k, x_k) = \sum_{k=1}^n I_k \cos x_k u \quad (5)$$

Card 1/3

S/109/62/007/006/005/024
D266/D308

Theory of unequally ...

where $x_k = 2d_k/\lambda$, d_k - distance of the k th element from the origin,
 λ - wavelength, I_k - current in the k th element, $u = \pi \cos \theta$, θ -
elevation angle. The currents are assumed to be real (all elements
in phase) and to satisfy the normalization condition

$$\sum_{k=1}^n I_k = 1 \quad (6)$$

Prescribing the magnitude and position of the side lobes the fol-
lowing equation system is obtained:

$$F(u_i) = \pm \mu, \quad i = 1, \dots, m \quad (1)$$

$$\left. \frac{\partial F}{\partial u} \right|_{u_i} = 0, \quad i = 1, \dots, m - 1 \quad (2)$$

Card 2/3

Theory of unequally ...

S/109/62/007/006/005/024
D266/D308

It is shown that if the number of the prescribed side lobes is equal to n the width of the main lobe is the smallest for a given μ . If the currents are allowed to vary the optimum array consists of equidistant elements and the radiation pattern is given by a Chebyshev polynomial. Introducing the restriction of equal currents in the elements and making

$$F(u_i) = (-1)^i \mu$$

the resulting algebraic equations are first transformed into a quasilinear differential equation system and then solved on an electronic computer. Examples are worked out for an 8-element and a 17-element array. A radiation pattern for the latter array for $\mu = 0.065$ is shown in a graph. The corresponding spacing of the elements: $x_1 = 0.654$, $x_2 = 1.439$, $x_3 = 2.077$, $x_4 = 2.904$, $x_5 = 3.733$, $x_6 = 4.688$, $x_7 = 5.911$, $x_8 = 7.379$. The width of the main lobe is 8.2 degree at the level μ . There are 10 figures and 2 tables.

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Card 3/3